CLAIMS

What is claimed is:

1. A magnetic resonance imaging system comprising:

a phased array coil assembly including a plurality of coils coextensively covering a predetermined area, each of the plurality of coils comprising a different number of loops over the predetermined area and dividing the predetermined area into at least three contiguous regions arranged linearly along the predetermined area; and

a signal processing circuit coupled to the phased array coil assembly for receiving a plurality of magnetic resonance signals detected by the plurality of coils, the signal processing circuit being configured to localize the plurality of magnetic resonance signals originating in at least one of the contiguous regions.

2. The magnetic resonance imaging system of claim 1, wherein the plurality of coils are configured to detect magnetic resonance signals from a same spatial sensitivity volume.

3. The magnetic resonance imaging system of claim 1, wherein at least one loop of a respective coil of the plurality of coils is configured to overlap a loop of a another respective coil of the plurality of coils to reduce mutual inductance between the plurality of coils.

4. The magnetic resonance system of claim 1, wherein the phased array coil assembly comprises at least four coils coextensively covering the predetermined area.

5. The magnetic resonance system of claim 1, wherein the phased array coil assembly comprises:

a first coil forming a single loop extending over the predetermined area;

a second coil coextensive with the first coil and forming two loops over the predetermined area;

a third coil coextensive with the second coil and forming three loops over the predetermined area; and

a fourth coil coextensive with the third coil and forming four loops over the predetermined area,

and wherein the predetermined area is divided into four contiguous regions arranged linearly along the predetermined area.

6. The magnetic resonance system of claim 1, wherein the phased array coil assembly comprises:

a first planar phased array coil assembly; and

a second generally similar planar phased array coil assembly disposed orthogonal to the first planar phased array coil assembly.

7. The magnetic resonance system of claim 1, wherein the phased array coil assembly, further comprises a plurality of self similar assemblies disposed to enclose a volume.

8. The magnetic resonance system of claim 1, wherein each of the plurality of coils is symmetrical about a horizontal axis with respect to the axis along which the plurality of coils is arranged.

9. The magnetic resonance system of claim 1, wherein each of the plurality of coils is symmetrical about a vertical axis with respect to the axis along which the plurality of coils is arranged.

10. The magnetic resonance imaging system of claim 1, wherein the plurality of magnetic resonance signals vary in phase with position of the plurality of coils.

11. The magnetic resonance system of claim 1, wherein the signal processing circuit comprises a plurality of splitters to split a plurality of magnetic resonance signals received from the plurality of coils, wherein each of the plurality of

magnetic resonance signals is split into a first pair of signals with 180 degrees phase shift and wherein each of the first pair of signals are further split into a second pair of signals with 180 degree phase shift.

12. The magnetic resonance system of claim 11, wherein the signal processing circuit further comprises a combiner circuit to combine the second pair of signals received from the plurality of splitters; wherein the combiner circuit is configured to yield a selective combination of the plurality of magnetic resonance signals which correlates to an individual contiguous region.

13. The magnetic resonance system of claim 1, wherein the signal processing circuit is configured to convert the plurality of magnetic resonance signals detected by the plurality of coils to a digital form and to perform localization computation to yield a selective combination of the plurality of magnetic resonance signals which correlates to an individual contiguous region.

14. The magnetic resonance system of claim 13, wherein the localization computation uses a Hadamard Transform.

15. A phased array coil assembly for magnetic resonance imaging comprising:

a plurality of coils coextensively covering a predetermined area, wherein each of the plurality of coils comprises a different number of loops over the predetermined area and dividing the predetermined area into at least three contiguous regions arranged linearly along the predetermined area.

16. The phased array coil assembly of claim 15 comprising at least four coils coextensively covering the predetermined area.

17. The phased array coil assembly of claim 15 comprising:

a first coil forming a single loop extending over the predetermined area;

a second coil coextensive with the first coil and forming two loops over the predetermined area;

a third coil coextensive with the second coil and forming three loops over the predetermined area; and

a fourth coil coextensive with the third coil and forming four loops over the predetermined area,

and wherein the predetermined area is divided into four contiguous regions arranged linearly along the predetermined area.

18. The phased array coil assembly of claim 15 comprises:

a first planar phased array coil assembly; and

a second generally similar planar phased array coil assembly disposed orthogonal to the first planar phased array coil assembly.

19. The phased array coil assembly of claim 15, further comprising a plurality of self similar assemblies disposed to enclose a volume.

20. The phased array coil assembly of claim 15, wherein each of the plurality of coils is symmetrical about a horizontal axis with respect to the axis along which the plurality of coils is arranged.

21. The phased array coil assembly of claim 15, wherein each of the plurality of coils is symmetrical about a vertical axis with respect to the axis along which the plurality of coils is arranged.

22. A phased array coil assembly for magnetic resonance imaging comprising:

a first coil forming a single loop extending over the predetermined area;

a second coil coextensive with the first coil and forming two loops over the predetermined area;

a third coil coextensive with the second coil and forming three loops over the predetermined area; and

a fourth coil coextensive with the third coil and forming four loops over the predetermined area,

and wherein the predetermined area is divided into four contiguous regions arranged linearly along the predetermined area.

23. The phased array coil assembly of claim 22, wherein the first coil, the second coil, the third coil and the fourth coil are symmetrical a horizontal axis with respect to the axis along which the phased array coil assembly is arranged.

24. The phased array coil assembly of claim 22, wherein the first coil, the second coil, the third coil and the fourth coil are symmetrical about a vertical axis with respect to the axis along which the phased array coil assembly is arranged.

25. A phased array coil assembly for quadrature detection in magnetic resonance imaging comprising:

a first phased array coil assembly comprising a plurality of coils coextensively covering a first predetermined area, wherein each of the plurality of coils comprises a different number of loops over the first predetermined area and dividing the first predetermined area into at least three contiguous regions arranged linearly along the first predetermined area; and

a second phased array coil assembly comprising a plurality of coils coextensively covering a second predetermined area, wherein each of the plurality of coils comprises a different number of loops over the second predetermined area and dividing the second predetermined area into at least three contiguous regions arranged linearly along the second predetermined area, and

wherein the second phased array coil assembly is disposed orthogonal to the first phased array coil assembly.

26. A phased array coil assembly of claim 25, wherein the first and second phased array coil assemblies are generally planar.

27. A phased array coil assembly of claim 25, wherein the first and second phased array coil assemblies are generally curvacious.

28. A magnetic resonance imaging system comprising:

a magnet assembly comprising:

a primary coil;

a transmit coil assembly;

a phased array coil assembly, wherein the phased array coil assembly comprises a plurality of coils coextensively covering a predetermined area, each of the plurality of coils comprising a different number of loops over the predetermined area and dividing the predetermined area into at least three contiguous regions arranged linearly along the predetermined area;

a control and processing circuit operatively connected to the magnet assembly, comprising a signal processing circuit coupled to the phased array coil assembly for receiving a plurality of magnetic resonance signals detected by the plurality of coils, the signal processing circuit being configured to localize the plurality of magnetic resonance signals originating in at least one of the contiguous regions;

one or more system controller circuits operatively connected to the control and processing circuit; and

an operator interface station operatively connected to the one or more system control circuits.

29. The imaging system of claim 28, wherein at least one loop of a respective coil of the plurality of coils is configured to overlap a loop of a another respective coil of the plurality of coils to reduce mutual inductance between the plurality of coils .

30. The magnetic resonance system of claim 28, wherein the phased array coil assembly comprises at least four coils coextensively covering the predetermined area.

31. The magnetic resonance system of claim 28, wherein the phased array coil assembly comprises:

a first coil forming a single loop extending over the predetermined area;

a second coil coextensive with the first coil and forming two loops over the predetermined area;

a third coil coextensive with the second coil and forming three loops over the predetermined area; and

a fourth coil coextensive with the third coil and forming four loops over the predetermined area,

and wherein the predetermined area is divided into four contiguous regions arranged linearly along the predetermined area.

32. The magnetic resonance system of claim 28, wherein the phased array coil assembly comprises:

a first planar phased array coil assembly; and

a second generally similar planar phased array coil assembly disposed orthogonal to the first planar phased array coil assembly.

33. The magnetic resonance system of claim 28, wherein the phased array coil assembly, further comprises a plurality of self similar assemblies disposed to enclose a volume.

34. The magnetic resonance system of claim 28, wherein each of the plurality of coils is symmetrical about a horizontal axis with respect to the axis along which the plurality of coils is arranged.

35. The magnetic resonance system of claim 28, wherein each of the plurality of coils is symmetrical about a vertical axis with respect to the axis along which the plurality of coils is arranged.

36. The magnetic resonance imaging system of claim 28, wherein the plurality of magnetic resonance signals vary in phase with position of the plurality of coils.

37. The magnetic resonance system of claim 28, wherein the signal processing circuit comprises a plurality of splitters to split a plurality of magnetic resonance signals received from the plurality of coils, wherein each of the plurality of magnetic resonance signals is split into a first pair of signals with 180 degrees phase shift and wherein each of the first pair of signals are further split into a second pair of signals (84) with 180 degree phase shift.

38. The magnetic resonance system of claim 28, wherein the signal processing circuit further comprises a combiner circuit to combine the second pair of signals received from the plurality of splitters; wherein the combiner circuit is configured to yield a selective combination of the plurality of magnetic resonance signals which correlates to an individual contiguous region.

39. The magnetic resonance system of claim 28, wherein the signal processing circuit is configured to convert the plurality of magnetic resonance signals detected by the plurality of coils to a digital form and to perform localization computation to yield a selective combination of the plurality of magnetic resonance signals which correlates to an individual contiguous region.

40. A method of detecting magnetic resonance signals comprising:

receiving a plurality of magnetic resonance signals using a plurality of coils of a phased array coil assembly, wherein the plurality of coils coextensively cover a predetermined area, each of the plurality of coils comprising a different number of loops over the predetermined area and dividing the predetermined area into at least three contiguous regions arranged linearly along the predetermined area.

41. The method of claim 40, further comprising transmitting the plurality of the magnetic resonance signals through the phased array coil assembly.

42. The method of claim 40, further comprising overlapping the loops of the plurality of coils for reducing mutual inductances between the plurality of coils.

43. A method of using a phased array coil assembly in presence of a gradient field system comprising:

receiving a plurality of magnetic resonance signals using a plurality of coils of the phased array coil assembly, wherein the plurality of coils coextensively cover a predetermined area, each of the plurality of coils comprising a different number of loops over the predetermined area and dividing the predetermined area into at least three contiguous regions arranged linearly along the predetermined area; and

processing the magnetic resonance signals detected by the phased array coil assembly.

44. The method of claim 43, further comprising overlapping the loops of the plurality of coils for reducing mutual inductances between the plurality of coils.

45. The method of claim 43, wherein processing the magnetic resonance signals comprises localizing the plurality of magnetic resonance signals originating in at least one of contiguous regions of the predetermined area being imaged.

46. The method of claim 45, wherein localizing the plurality of magnetic resonance signals comprises:

correlating each of a contiguous regions with a corresponding predetermined combination of a plurality of magnetic resonance signals received from each of respective plurality of coils using phase shifts of the plurality of magnetic resonance signals received from each of respective plurality of coils.

47. The method of claim 46, wherein the predetermined combination of the plurality of magnetic resonance signals comprises using a combiner circuit before converting the magnetic resonance signals into a digital form.

48. The method of claim 43, wherein processing the magnetic resonance signals comprises splitting a plurality of magnetic resonance signals received from the plurality of coils into a first pair of signals with 180 degrees phase shift and wherein splitting each of the first pair of signals into a second pair of signals with 180 degree phase shift.

49. The method of claim 48, wherein processing the magnetic resonance signals further comprises combining the second pair of signals to yield a selective combination of the plurality of magnetic resonance signals which correlates to an individual contiguous region.

50. The method of claim 43, wherein processing the magnetic resonance signals further comprises converting the plurality of magnetic resonance signals detected by the plurality of coils to a digital form and performing localization computation to yield a selective combination of the plurality of magnetic resonance signals which correlates to an individual contiguous region.

51. The method of claim 50, wherein the localization computation uses Hadamard Transform.

52. An image created using the method of claim 40.

53. An image created using the method of claim 43.